JPRS 78791

19 August 1981

East Europe Report

SCIENTIFIC AFFAIRS

No. 711

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CONTENTS

ACTIVITY OF INSTITUTE OF NUCLEAR PHYSICS DESCRIBED

Tirana ZERI I RINISE in Albanian 15 Jul 81 p 3

[Interview with Petrit Skendi, deputy director of the Institute of Nuclear Physics]

[Excerpts] Question: Over the years the Institute of Nuclear Physics has carried on a broad scientific research activity in cooperation with production centers and institutions and has made a great contribution to the solution of many problems facing production. Our readers would like to hear about some of the achievements of this institute.

Answer: One of the first achievements was the use of radioactive trackers in monitoring the drilling columns in oil wells and the extension and perfecting of the so-called nuclear logging process; these two methods are being used successfully by the petroleum geophysics enterprise in Patos. The institute has also directed its attention toward medicine where it has done good work in regard to the use of radioactive isotopes in the diagnosis of illnesses. On the basis of the results achieved two specialized clinics have been set up and are in operation. They are equipped with the latest technology and they are continuing their cooperation with the institute in the area of nuclear medicine.

In agriculture, radiation is used on seeds before planting in order to stimulate productivity and interesting results have been achieved in crops such as tomatoes, tobacco, beets, wheat, etc. Radiation is also used in selection work so as to get new varieties on the basis of the effect which the radiation has on embryo cells. In this activity there is cooperation among many agricultural research centers and stations and higher schools.

The results achieved in monitoring the dynamics of phosphate fertilizers marked with radioactive phosphorus (P-32) are interesting. Also of interest are the results of the monitoring of the dynamics of nitrogen fertilizers marked with stable nitrogen-15 detected by mass spectrometric techniques. Other results include the successful use of nuclear analytical methods such as activation by neutrons and fluorescent X-rays.

These two methods are in the category of instrumental methods. They are based on the assault of the nucleus of the atom or its electronic layer by bombarding with neutrons or gamma rays and they the quantitative determination of the element is made on the basis of the second radiation which is produced. The geology sector and, in particular, the geophysics enterprise in Tirana, are working closely with the institute on these methods which are widely used.

Interesting studies have been made on natural radioactivity and trackers have been used in regard to the problems of the sedimentology of the coast and the ports. The results dealing with the operations of the ports of Durres and Vlore have been received with interest and their economic importance has been appreciated. One might mention the work for the electronic radiation of polyethylene in order to achieve a material with improved physio-chemical properties which is needed for the electrical industry and in communications; the work in nuclear electronics to design and construct nuclear control devices for industry (the Maliq sugar factory, the glass factory, oil wells, etc.), a work in the area of hydrology and hydrogeology to study the movements of underground waters, etc.

Question: On the basis of the guidelines and duties set by the 8th plenum of the Central Committee of the party what concrete scientific work has the Institute of Nuclear Physics assumed at the present time? What are some of the directions in which this work has been concentrated this year?

Answer: The duties assigned by the 8th plenum of the party Central Committee are an extensive long-range program of work in the field of nuclear physics which envisages improved quality and new directions.

This year in the institute, groups of nuclear analytical methods are making an effort to expand the number of elements which are able to be determined at low content levels. Copper, iron, chrome, manganese, nitrogen, rare soils, mercury, etc., are some of the elements in regard to which nuclear methods have had noticeable successes over chemicals.

The institute has progressive computing technology, using small computers for the automation of the processing of spectrums in analytical measures, which considerably increases the effectiveness of nuclear analytical methods.

Work on the stable nitrogen isotope for fertilizers is being expanded.

In the nuclear eletronics group some measurement and control apparatuses are under construction and work is being done to expand the knowledge of microelectronics and integrated circuits of a high level. On the basis of good experimental material, work is being done to reach conclusions on the advantages of radiation in preserving food products.

Studies on the physical aspects of the methods of recording radiation in order to achieve exact measurements of radioactive isotopes are being expanded.

The institute has a work plan on the development of laser physics in Albania, an area with great applicational value, and the first organizational measures are being taken to raise neutron physics to a new qualitative level, anticipating the construction of an experimental reactor in the country.

Many applications in industry, geology and other areas are in the work plan for this year.

Question: What is the involvement of young specialists and of the youth in general in the application of new nuclear methods in production. What are their duties?

Answer: I believe that two ancillary elements ensure the success of work in nuclear physics: a good knowledge of mathematics and skill in experimental work, and especially, in electronics. These are two fields in which the great pace of development can be met only by the sound and fresh ideas of the youth. I believe that stronger ties between the institute and the university faculties, especially, the branches of physics and electronics, will be helpful. The largest number possible of young students from the faculties of natural sciences and engineering should come to the institute to prepare for their degrees and course work in the field of nuclear methods which have become truly universal in their use.

CSO: 2102/5

STATUS OF COMPUTER DEVELOPMENT REVIEWED

Prague VYBER INFORMACI in Czech No 1, 1981 pp 3-36

[Article: "Data Processing Equipment in Bulgaria"; text sections, figures and tables renumbered]

[Text] 1. The Status and Development of Electronic Data Processing Equipment in Bulgaria

Our experience with the use of data processing equipment in the 1960's indicated to us that this equipment operates most effectively when the machines used in automated systems are program and device compatible. Only these progressive principles guarantee interchangeability of both individual devices and entire systems. The design of such unified systems, however, requires major expenditures on development, design, production and technical maintenance of the equipment used. The Bulgarian People's Republic does not have such resources. Accordingly, Bulgaria did not begin the development, production and application of electronic data processing equipment in earnest until 1969, after the JSEP [Unified System of Electronic Computers] was created.

The leading body for the development, production, export and technical servicing of computers and accounting equipment is the state economic association ISOT in the Ministry of Electrical Engineering and Electronics. The Institute of Data Processing Equipment, a part of ISOT, is in charge of most research work and also of design capacities for the data processing and accounting equipment sector.

Fig. 1. The EC 1022 B computer has been in series production since 1976.

1.1. Main Directions in the Development of Electronic Data Processing Equipment in Bulgaria

1.1.1 Electronic Data Processing Equipment (Mainframe Computers, Control Units, Small Computers)

The development of data processing equipment is taking several main directions in Bulgaria. The first of these consists of the development and production of systems of electronic machines. Within the Unified System, Bulgaria produced the EC 1020 B computer jointly with the Soviet Union between 1972 and 1977. Since 1976 it has been producing the EC 1022 B on the basis of Soviet specifications. This computer exists in three variants which different main memory capacities of 128, 256 and 512 Kbyte. The user can attach various peripheral devices via a multiplex channel and two selector channels. The EC 2622 mainframe computer differs from the EC 2620 by having a higher operating speed (up to 100,000 operations per second), a larger main memory (512 Kbyte) and a faster channel speed. This means that it can be connected to peripherals with higher operating speed and greater memory capacity.

The EC 1022 B operates under the control of the DOS/ES operating system. But when using the EC 1022 B, the user may also employ the OS/ES system. As the range of applications of the Unified System is expanded, program packages for various purposes are being refined. Last year, production of the new EC 1035 computer, which belongs to Series II of the Unified System, was begun using Soviet documentation. In comparison with the EC 1022 B, the EC 1035 has a much more extensive capabilities and embodies fundamental innovations in architecture, engineering and manufacture. The EC 2635 mainframe, for example, has a higher speed (three times that of the EC 1022 B), a larger main memory (1 Mbyte), and virtual memory. Virtual memory enables the user to operate with a maximum capacity of 16 Mbyte in 16 programs. In addition, microprogrammed emulation of the Minsk 32 computer is being prepared.

Fig. 2. Program testing on the EC 1035. The EC 2635 mainframe unit has been in production in the Sofia Data Processing Equipment Plant (ZIT) since 1979.

The EC 1035's more extensive instruction set (compared to Series I of the Unified System) increases operating capabilities. It also features block multiplex operation of selector channels. This means that the peripherals engage the mainframe only while exchanging data with working memory.

The equipment's diagnostic capabilities and reliability have been substantially improved. The channel speed makes it possible to connect new peripherals such as 100 and 200 Mbyte disk systems, magnetic tape systems with higher recording density and the like.

The second aspect of this first main direction is the production of control units. These devices control rapid access memory using magnetic media (tapes and disks). The EC 5561 control unit was designed to control the EC 5061 replaceable-disk storage unit. The selector channels of the EC 1022 B and the disk storage unit are connected by a standard interface which operates under microprogram control and can control eight disk units plus external storage simultaneously. The EC 5561 allows exchange of data between the channel and disk store and monitors the information transferred. The data format is in accordance with ISO requirements. A cyclic code is used to monitor the information transmitted. In stand-alone operation, the EC 5561 allows independent diagnosis of disk memory units. The EC 5561 control unit, together with the requisite number of disk storage units, enables the computer system to operate with either DOS/ES or OS/ES.

The EC 5512 control unit is used to control magnetic tape storage devices and is connected to selector channels by a standard interface. This unit controls eight EC 5012 magnetic tape storage units with tape speeds of 2 m/sec and 9-track recording. Data can be read when the tape is moving in either direction. The

data are monitored by three methods simultaneously. The EC 5512 can be switched to stand-alone operation using built-in features.

The third aspect of the first production series is small computers. The ISOT 310 small computer was developed in Bulgaria, and its production has been begun. This general-purpose computer is designed, among other things, for scientific and technical calculations, for real-time automatic control of production processes, for primary processing of economic data, for remote control and for data processing. It may be used as a component of more complex hierarchical systems.

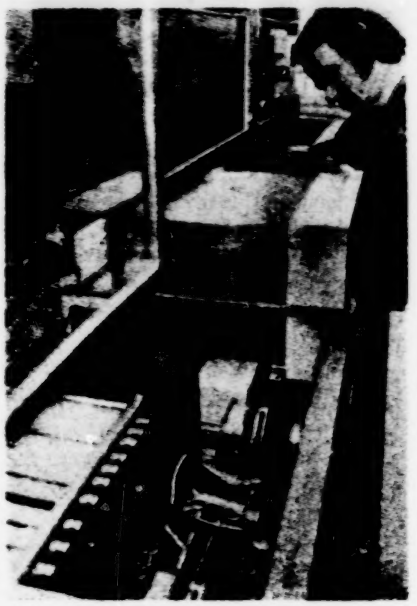


Fig. 3. The ISOT 310, a general-purpose small computer or component of a hierarchical computer system.

The ISOT 310 has rapid-access memory, an extensive and powerful instruction set and a flexible I/O system. This gives it high operating speed and the possibility of adding on magnetic tape and disk storage units, punched card readers, printers, analog-digital converters, displays, plotters and the like.

Modular system design makes it possible to expand the configuration by simple adding on of supplementary units. The main memory, with a capacity of 4K 12-bit words and a 2 microsecond access cycle, can be expanded to 128K words in 4K increments.

The set of programs for the ISOT 310 enables it to operate in combination with equipment of a higher class (computers).

Production of the CM 4 computer of the SMEP series [System of Small Electronic Computers] is currently being prepared. Series production is to begin this year.

1.1.2 Peripheral Devices

The second main direction consists of the development and production of peripheral memory units, of the tape, fixed-disk and replaceable-disk types. The EC 5012 magnetic disk storage unit was the first Bulgarian-produced device in the Unified System. It underwent joint tests and was put into series production at the end of 1971. Currently the EC 5012-03 modification of this device is in production. It is of light design, which makes it easy to handle each modular block in installation and repair, and affords higher operating reliability, a 3 m/sec tape speed and a rewind time of 120 seconds. Semiautomatic tape setup decreases the average time required to replace a tape to 1 minute. The EC 5012-02 modification, with a high tape speed of 3 m/sec, was developed from the same machine, and uses the NRZ I recording system and phase coding.

The development of the EC 5003 tape drive has been completed, and production will begin this year. Phase coding is used as the recording method. In addition, it also uses the NRD I recording method, which makes it possible to exchange information with other memory units that use this recording method.

The EC 5003 tape drive is connected by a diagnostic interface to the control unit and transmits 10 bytes of detailed information for memory unit diagnosis. The tape speed is 5 m/sec, which allows a high transmission rate of 315 kbyte/sec. The rewind time is 45 seconds. Automatic tape setup results in a considerable decrease in the time required for changing reels and eliminates damage to the tape. A glass window in the front opening is raised and lowered automatically. The fixed magnetic head cover and the fact that the magnetic tape comes into contact only with the magnetic heads and the tape cleaner are additional advantages of this device.

There are two modifications: the basic modification, the EC 5003, which is connected to the Czechoslovak EC 5503 control unit, and a supplementary modification with a tape speed of 3 m/sec (EC 5003-03), which operates with the Soviet EC 5525 control unit.

The EC 5052 and EC 5061 disk pack storage units are the best-known models.

This year the production of a new generation of disk units will begin. The first of these is the EC 5067-01 unit (the EC 5067-01 has a capacity of 100 Mbyte, the EC 5067-02 a capacity of 2 x 100 Mbyte, and the EC 5067 a capacity of 200 Mbyte). It is designed for use in a system of computers from Series II of the Unified System, or in configurations equivalent to this system. The disk drive may be designed for use with either the EC 5567 control unit or the EC 5667 control module, or with the EC 5667 control module alone (in integrated combination).

The EC 5067-01 consists of two independent drive units, each of which reads from or records on an EC 5266, IBM 3336, Mark 10 or equivalent disk pack. The disk

packs are replaceable. Information recorded on one of the drives can be read by either the second drive or by another disk storage unit of the same type.

Local control and indication of machine condition is done at two control consoles.

The EC 5067-01 allows the following basic operations: positioning, recording, reading, and response to commands from the control unit or control module. Recording and reading are done by means of so-called "floating magnetic heads" made of ceramic. The disk store has a total capacity of 100 Mbyte and an average access time of 30 ms. The transmission speed is 806 kbyte/sec, and the recording density on the 000 cylinder is 106 bits/mm.

Several types of removable disk packs are produced in Bulgaria: the EC 5053, EC 5261 and EC 5269 A. This year, production of the EC 5267 disk pack, with a capacity of 100 Mbyte, will begin. It is intended for use with the EC 5066, EC 5067, EC 5067-01 and EC 5067-02 and with other disk storage devices of the same type. This disk pack contains 10 working disks, including one service side and 19 working sides, and complies with all requirements of the ISO. Its production is so oragnized that the disk packs can be manufactured to purchaser specifications.

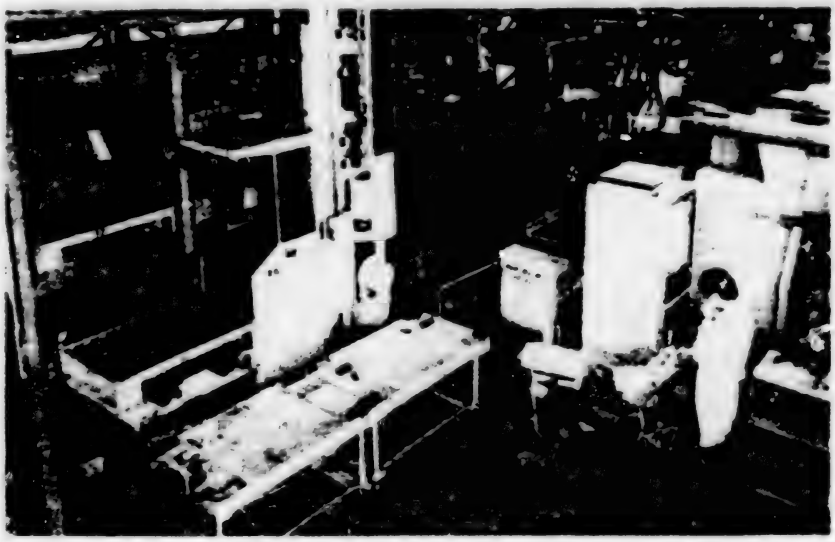


Fig. 4. Increasingly modern computer equipment is being introduced for production control in the Bulgarian People's Republic.

Particular attention is still being devoted to the development and production of external storage for small computers in the SMEP series. Currently three types of magnetic tape storage units are being produced: the ISOT 5003, with a tape speed of 0.32 m/sec and a 12-kHz transmission band, the ISOT 5005, with a tape

speed of 0.65 m/sec and a 16-kHz transmission band, and the ISOT 5004 (CM 5300) with a tape speed of 0.32 m/sec and a 2-kHz transmission band. All of these have a recording density of 32 bits/mm and a reel diameter of 267 mm and use the NRZ recording method.

The ISOT 1370 small disk storage unit has a capacity of 6 Mbyte, 4 disk sides, a 2.5 MHz transmission band, an average access time of 55 msec and a recording density of 90 bits/mm. The development of two other small disk storage units with capacities of 3 and 12 Mbyte is close to completion.

The CM 5400 disk pack memory, an improvement of the ISOT 1370, is being produced for the small computer series. It is used for recording, storing and reading out information while functioning as external storage for the CM 1, Cm 2, CM 3 and CM 4 small computer systems. Up to 4 storage units can be connected radially or serially to one control unit. These storage devices (the ISOT 1370 and the CM 5400) use EC 5269 A disk packs, which have been in production in Bulgaria since 1975.

In addition, Bulgaria is producing a floppy-disk memory with a capacity of 3.2×10^6 bits.

1.1.3 Data Collection Units

In recent years, the quantity of data earmarked for electronic processing has been increasing greatly, and accordingly Bulgaria has developed the EC 9002 magnetic tape data collection unit using small magnetic tape drives. Development of two other microprocessor-based data collection units has been completed; these are the EC 9112 which records the data on floppy disks and the EC 9113 with output via the ISOT 5003 magnetic tape unit.

The EC 9003 system includes a card punch and controller, a paper tape punch, or certain other devices used for data collection and recording. The system increases operator labor productivity by 40 to 45 percent over that achieved with keypunch units. The computer provides the "intelligence" which the stand-alone device needs for direct recording on magnetic tape. The data entry stations are equipped with a keyboard and display. Information entry formatting, real-time monitoring, automatic operation, automatic addition of identifiers, reformatting and other system capabilities included in software simplify the operator's work and increase data entry productivity. Printed reports on the condition of the system and operator productivity make possible flexible operation and a continuous data recording process.

1.1.4 Equipment for Teleprocessing

Directly associated with electronic data processing are the ESTEL teleprocessing systems: they comprise a variety of teleprocessing systems consisting of hardware and software developed outside the Unified System. The program compatibility of various models, the uniformity of information codes, standard unified data processing system interfaces and transmission equipment developed in accordance with the CCITT recommendations create the conditions for flexible organization of

a system for a variety of uses. All of these factors give the unified electronic data processing system an extensive range of usability in sectors which require information processing, for example in planning and assignment work, design and scientific activity, and in the control of production processes, in scientific institutes, economic associations, ministries and the like.

1.1.5 Microprocessors

The ISOT 0250 automatic accounting and invoicing unit uses MOS LSI circuitry. When it is used in combination with diskettes, the information can be further processed in SMEP computers.

The ISOT 1002 C automatic text processor is also microprocessor-based. This allows setting up and correction of texts, compilation of documents according to standard text samples, and duplication of the recorded text. It also has the following capabilities: correspondence, text search in external memory, and automatic formatting of the text to be printed out.

The ISOT P 220 microcomputer was developed to utilize the advantages of microprocessors. It is intended, for example, for the design and development of systems for primary processing of data, control units for peripheral devices, and units for controlling manufacturing processes and automatic testing devices.

The ISOT 0220 microcomputer has modular structure, which increases its flexibility and applications capabilities. It consists of the following modules: microprocessor module, I/O module, main storage module, and ROM module.

An arrival and departure monitoring system has also been developed from the ISOT 0220. This automatic system monitors enterprises or institutes with up to 6,500 employees. It produces reports on arrivals and departures of each employee in each calendar day.

1.1.6 Electronic Pocket or Desktop Calculators

Bulgaria was the first socialist country to produce and export pocket and desktop models of electronic calculators.

The ELKA 105 and ELKA 131 pocket calculators for economic calculations and the ELKA 135 for engineering and technical calculations are attracting interest.

Among desktop calculators, we should mention the ELKA 35 with a printer and the ELKA 58 with a digital display and a small printer. They are intended for performance of a wide range of mathematical, engineering-technical, scientific and practical tasks.

Considerable attention has been devoted in Bulgaria to developing cash registers and putting them into production. For example, the ELKA 89 electronic cash register is used for processing and recording economic information.

There are two modes of operation: stand-alone and off-line.

The ISOT 310 minicomputer is used as the mainframe in the off-line variant. The VMK 212 module [kazeta] is used for connection to the computer. The cash registers are used in shops in the retail network, restaurants, department stores and the like. The electronic cash registers are based on a system consisting of the ISOT 500 microprocessor and TTL circuitry.

1.1.7 Manufacturing Systems and Equipment

Several manufacturing systems are available in Bulgaria for automating production.

For example, the EC A 527 set of control disks, now in production, allows quantitative evaluation of the dynamic imbalance of disk drive spindles.

A small computer, an adapter interface and a specialized control unit make up the system which Bulgarian specialists have developed for final testing of magnetic disk storage units or disk packs in production conditions.

The Senk 0310 system is used to automate the most basic work in the construction of digital devices, the making of wiring connections. This system makes it possible to replace manual wrapping [navijeni] of the connections with semiautomated wrapping, which increases the quality, speed and reliability of installation. The system consists of the ISOT 310 minicomputer, the S 103 group control unit, a semiautomatic wire wrapping unit with two-axis positioning, a paper tape reader and a printer.

This work represents only a small part of the overall electronic data processing equipment work being done in the Bulgarian People's Republic.

Production relies on a high level of specialization and cooperation, on the introduction of mechanization and automation facilities, and on a purposeful attitude on the part of scientific and technical personnel.

2. Microprocessor Systems

Microprocessors can be used in the design of more narrowly specialized systems. They lack such disadvantages of specialized LSI circuits as long design time, high development costs and the like. The time required to develop a new microprocessor system is only a fraction of that required for specially designed logic. The great advantages of microprocessors in the design of systems have gained them extremely extensive use in all areas of the economy: data processing equipment, electronic accounting equipment, machine design, trade, transport, industry, science, and domestic electrical consumption.

In many cases, microprocessors can replace small computers, particularly in small or medium-sized systems. In addition, microprocessors are an order of magnitude cheaper and considerably more reliable. The introduction and production of the CM 600 group of microprocessors and small peripheral devices in Bulgaria laid the groundwork for Bulgaria to become one of the main producers of microprocessor systems among the CEMA member states.

2.1. The ISOT 0250 Economic Data Processing System

The ISOT 0250 automatic accounting and invoicing unit is used in large information systems to collect and perform primary processing of economic data at the point of origin. It also acts as an independent unit for data processing in small and medium sized enterprises and institutes. All input data are recorded in floppy disk memory.

The ISOT 0250 system includes:

--a microprocessor-based central control unit with 12 Kbyte working memory for data and programs,

--an alphanumeric, digital and functional keyboard,

--digital and functional indication,

--an EC 7187 printer,

--an EC 5074 disk storage unit with two drives.

The following basic operating modes are possible in the ISOT 0250 system:

--entry into working storage from the keyboard of a program written in a problem-oriented language and its conversion to machine language,

--testing of the program by means of specified examples,

--transfer of the program into diskette storage,

--entry of input data and constants into working memory and transfer to diskette storage,

--execution of the program recorded on floppy disk, thus obtaining the required results.

The ISOT 0250 system was used as the basis for developing systems for planning and managing work in industrial enterprises and industrial agricultural complexes. The set of application programs for industrial enterprises includes:

--quantitative and qualitative accounting for commodities, and sales accounting by customer,

--automatic preparation of dispatching documents,

--maintenance of accounts receivable and payable,

--automatic composition of process documents and automatic retrieval of work orders with data on labor time and materials,

--preparation of materials consumption sheets and monitoring of adherence to prescribed limits,

--monitoring of production plan fulfillment and preparation of daily, weekly, monthly and quarterly reports.

The system developed for planning and management of agricultural activities includes:

--drawing up of plans and reports on their fulfillment,

--comparison of the plan with accounting reports, yielding data on the results of agricultural work,

--accounting work, including materials documentation, calculation and record keeping on amortization, and preparation of statements for the bank,

--documentation of agricultural products produced and sold,

--documentation and planning for the machinery inventory,

--calculation of wages and the like.

2.2. The ISOT 1002 C Text Processing System

One of the newest and most promising areas of microprocessor utilization is text processing.

The ISOT 1002 C text processing system is intended for compilation, editing and duplication of text. In addition to traditional editing work, the following functions can be performed:

--deletion of passages,

--insertion of text,

--replacement of text,

--tabulation,

--centering of text,

--document search,

--combining of documents,

--compilation of documents from standard text passages.

Fig. 5. The ISOT 1002 C text processing system.

Information inputs are monitored and information displayed on 24-line, 80-character displays; the format of the information displayed can be programmed in advance according to user needs. A cursor controlled from the keyboard gives coverage of the entire displayed text, indicating the location at which correction is to be made.

The EC 7187 alphanumeric printer gives good, high-quality printing. By changing the type face it is possible to print in either the Latin or Cyrillic alphabet.

The information supplied is stored on diskettes and can be reused for duplication or correction.

The ISOT 1002 C system includes:

--a microprocessor system and control console,

--an EC 5074 floppy disk unit with two drives,

--an EC 7187 alphanumeric type printer,

--a monitor to display the information entered.

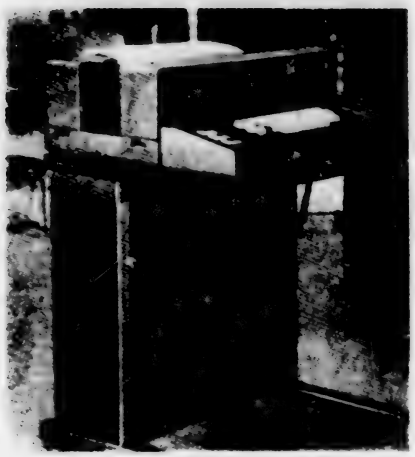


Fig. 6. The ISOT 0232 control console.

Fig. 7. The WKP 171 display.

2.3. The EC 9112 Data Collection Unit

The EC 9112 data collection unit may be used in computer centers and enterprises and the like for data collection on floppy disks. In addition to performing the traditional functions assigned to punched cards, punched tape and magnetic tape devices, the EC 9112 unit offers the following capabilities:

--location of a block by its address, location of the end of data,

--copying,

--addition (entry) of blocks,

--monitoring,

--diagnostics,

--preparation of head-of-list entries,

--work with a program sequence.

The advantages of the floppy disk data collection unit as compared with the data collection equipment used hitherto are:

--extensive capabilities available to the programmer,

--possibility of adding one or more keyboards with minimal increase in the size of the unit,

--more flexibility in data entry.

The EC 9112 data collection unit includes:

--a microprocessor system and control console,

--an EC 5074 floppy disk storage unit with two drives,

--a monitor to display the information entered.

The development and rapid beginning of production of the systems provides the groundwork for automatic control and administrative work, commercial activity and work with Bulgaria's finances using modern equipment.

Fig. 8. Printed circuit boards are assembled and tested in this plant in the north Bulgarian city of Russe. The enterprise is an important subsupplier for computer production.

3. Development of Replaceable-Disk Memory

The first replaceable-disk storage unit in the Unified System, the EC 5052, with a capacity of 7.25 Mbyte, was developed in 1970. Series production began in 1971. This storage unit has gone through several modifications since that time. In addition, the EC 5061 replaceable-disk storage unit, the ISOT 1370 small disk storage unit and the EC 5074 diskette storage unit have been produced or are in production.

Fig. 9. The first replaceable-disk storage unit in the Unified System, the EC 5052 with a capacity of 7.25 Mbyte.

In 1978, progress in replaceable-disk storage in Bulgaria resulted in the development of the EC 5067-02 storage unit, which has a capacity of 2 x 100 Mbyte. This storage unit combines new manufacturing and operating principles with large capacity, high data transmission speeds, a satisfactory access time, high reliability, and ease of operation.

The first EC 5067-02 storage units with a capacity of 2 x 100 Mbyte are already in series production. In the meantime, however, the developers have produced the EC 5067 replaceable-disk storage unit, with a capacity of 200 Mbytes (in a single disk pack). Both units operate with the EC 5667 control module and the EC 5567 control unit. They can be included in the system configuration of all Series II Unified System computers as direct access storage devices.

3.1. New Technology for the Production of Replaceable-Disk Storage Units

The development of future replaceable-disk storage units will have to meet the following requirements:

--higher capacity,

--higher reliability,

--better support to the user,

--usability in a wider range of environmental conditions,

--lower cost.

Information module technology (interchangeable and noninterchangeable information modules) appears to be a way of meeting these requirements.

In the near future, the following main tasks must be accomplished:

--use of a hermetically sealed module as part of the disk pack,

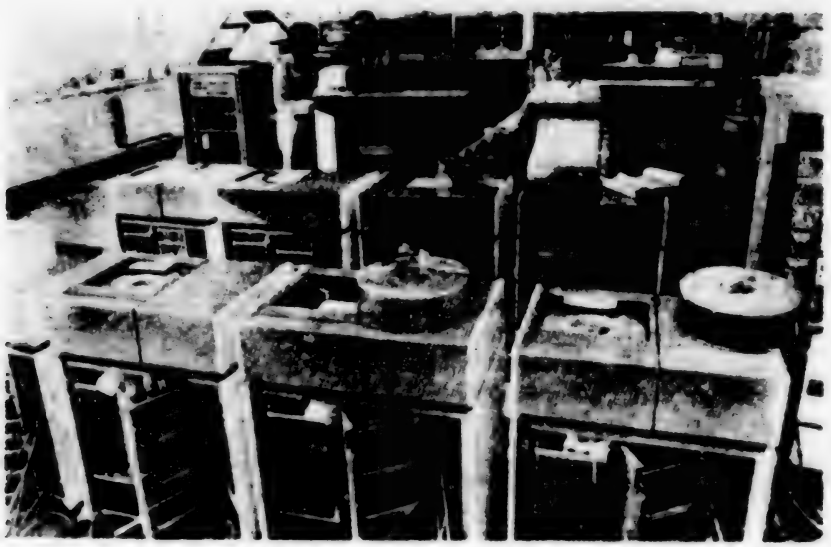
--development of new head types (using semiconductor technology),

--mastery of new methods of coding information on the working surfaces and increasing the recording density and number of tracks,

--increasing recording speed and data transmission capacity.

The recording density on modern disk surfaces can be increased by 20 to 30 percent without any alterations. But the production of higher-precision surfaces (with a uniform distribution of magnetic particles) with a suitable surface smoothness could make it possible to achieve a limit of 400 bits/mm and 40 tracks/mm by decreasing the distance between the head and the surface.

The weight and dimensions of the magnetic heads are being decreased. Problems will include not only amplifying the weak signal read from the surface (against practically constant noise), but also the effect of changes in signal amplitude resulting from nonuniform head movement. The design and low weight (less than 10 grams) allow safe positioning and raising of the heads.



Modern servosystems of disk pack memories with electronic head positioning use servoheads with a set of 20 to 30 read and write heads. If precise tracking of the midlines of the tracks is performed only on the servosurface, the radial alignment becomes increasingly important for all the other heads, particularly in case of high track density. Two possibilities for solving this problem suggest themselves:

--design of nonremovable information modules,

--use of universal read/write heads for reading the servoinformation on the track as well as data.

The only possibility for increasing the recording density within the track is an optimal combination of coding method and error correction code. Coding methods in which each remagnetization would correspond to more than 1 bit are being sought.

A suitable error correction code would ultimately increase both the recording density (capacity) of the track and its reliability, in spite of the small area on the track for control and correction information.

Increasing the capacity in the case of replaceable disks must not be considered separately from the system in which the storage unit ts to operate.

The reliability of replaceable-disk memory is being increased by means of microprocessors which control not only the interface but the servosystem and error diagnosis and elimination.

There are certain uses of small computers which make fundamental demands on small disk storage, such as:

--compact design so that the devices can be installed in standard housings,

--usability in non-climate-controlled areas,

--simplicity of operation, high reliability and low cost.

In order to meet a variety of user requirements, there are two groups of small disk storage units: cartridge memory with a capacity of 6, 12 or 24 Mbyte, and disk storage modules with replaceable disks and with capacities up to 80 Mbyte.

The third group of storage units for small computers is those with floppy disks, which are also being further developed as regards capacity and transmission capacity.

In the future these storage units will have a standardized mechanical design and modular electromechanical assemblies. This objective is economically beneficial for both use and production.

Another innovation is buffer memory located between the control unit and the disk storage unit. Such memory units have small capacity, but they can be used to increase the productivity of the disk subsystem by an order of magnitude, while requiring no changes in the devices themselves; i.e. complete software compatibility is maintained.

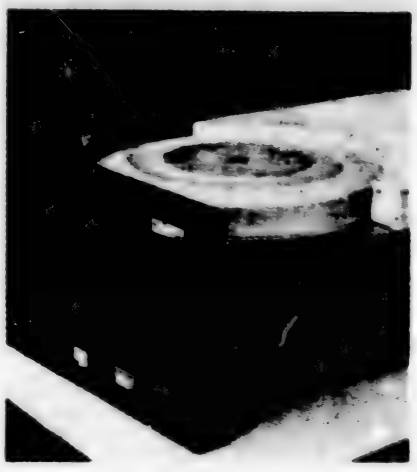


Fig. 11. The ISOT 1370 replaceable disk storage unit has a capacity of 6 Mbyte.

3.2. Structure and Function of the EC 5067-02 Disk Pack Storage Unit

The main innovation in this storage unit is the placement of the working surface on a set of platters. The data recorded on the working surface are used to:

--carry out head magnetization and demagnetization operations and regeneration instructions,

--generate (cylinder) count pulses during the search operation,

--carry out head displacement operations,

--monitor the angular position of the disk pack,

--emit an index signal,

--synchronize data during the recording operation.

We will consider three of these uses of servosignals. The displacement operation was introduced in order to increase memory reliability. If the data are incorrectly played back during reading, a series of attempts to read them are made,

during which the heads are displaced up to 40 microns to either side of the center lines of the tracks. In this way, "soft" errors are corrected and possible inaccuracies in the radial alignment of the heads are compensated. Displacement is ruled out in the recording (writing) operation.

The data can be placed on the tracks in the form of records, whose number and length may vary. The time between the index pulse and the performance of the required entry onto the track is known as the "wait time." To decrease this time interval and allow the central processor to carry out other operations, monitoring of the angular position of the disk pack has been instituted in replaceable-disk memory.

The disk pack is arbitrarily divided into 128 identical sectors, each of which has a length of 105 bytes (13,440/128 = 105). Two serially connected counters participate in forming the sector address (from 000 to 127): the servopulse counter and the sector counter.

If the period following passage over the servopulses amounts to 2,480 microseconds, this would correspond to 52.5 pulses per sector. In order to avoid this problem, a division is made into even sectors containing 53 servopulses (from 0 to 52) and odd sectors containing 52 pulses (from 1 to 52). Each output pulse from the servopulse counter increases the contents of the sector counter by 1. Both counters are erased by the index signal. Replaceable-disk storage contains a flip-flop ("second half of sector") which is set at 1 after each 23d pulse. This produces information on a smaller time interval than that represented by the sector.

If all records on a given track are the same length, it is possible to calculate the addresses of the sectors in which the records begin. In this case a 113 (115 - 2) is entered in the sector address register. When the contents of the sector counter reaches 113, an interrupt signal is fed to the control module. The time corresponding to the passage through two sectors (in this case from 113 to 115) is always specified so that the central processor can interrupt the operation which it is performing and prepare to receive the data recorded from record No 20.

The duration of the passage through each sector is about 130 microseconds.

The index signal is a sequence of binary 1's and 0's in the servoband with the following coding: 11 01 01 10 (in protection bands, the index signal is also generated, but with a binary 1). This sequence is present on all bands in the disk pack and forms a very narrow cylindrical sector in the pack.

To eliminate spurious generation of index signals, this sequence can be decoded only during the 50th, 51st and 52nd servopulses of sector 127 and the 0th, 1st, 2nd and 3d pulses of sector 0 (the so-called "index window").

Fig. 12. Data recording in the EC 5067-02.

The modified frequency modulation recording method allows high recording density. The records change length in accordance with the cylinder number, with allowance made for differences in the behavior of the heads. Preliminary compensation during recording decreases the effect of phase errors with different code combinations.

Another innovation in replaceable-disk memory is the monitor, which monitors correct performance of the basic operations in memory. These operations correspond to seven different monitor operating modes: head magnetization and demagnetization, regeneration, search, end of search, extraction, recording, and sequencing.

Each mode is further divided into eight states. When the operations are performed correctly in the disk unit, these states are activated in order. If one of them appears before the previous state is activated, the flip-flop [klopny] monitor is set at 1.

To monitor the condition of the disk store, there is a so-called "diagnostic register" (three filp-flop circuits) in which one data item is entered via bus BU 1-3 by means of instruction 12. This datum specifies six diagnostic modes. The circuits to be diagnosed have separate inputs which are independent of the inputs activated during normal operation.

The interface with the disk store which is used, namely the control module, differs in organization from that in the 7.5 Mbyte and 29 Mbyte disk storage units.

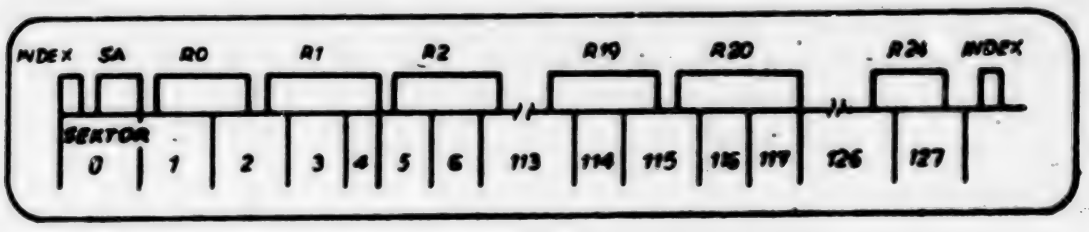


Fig. 12

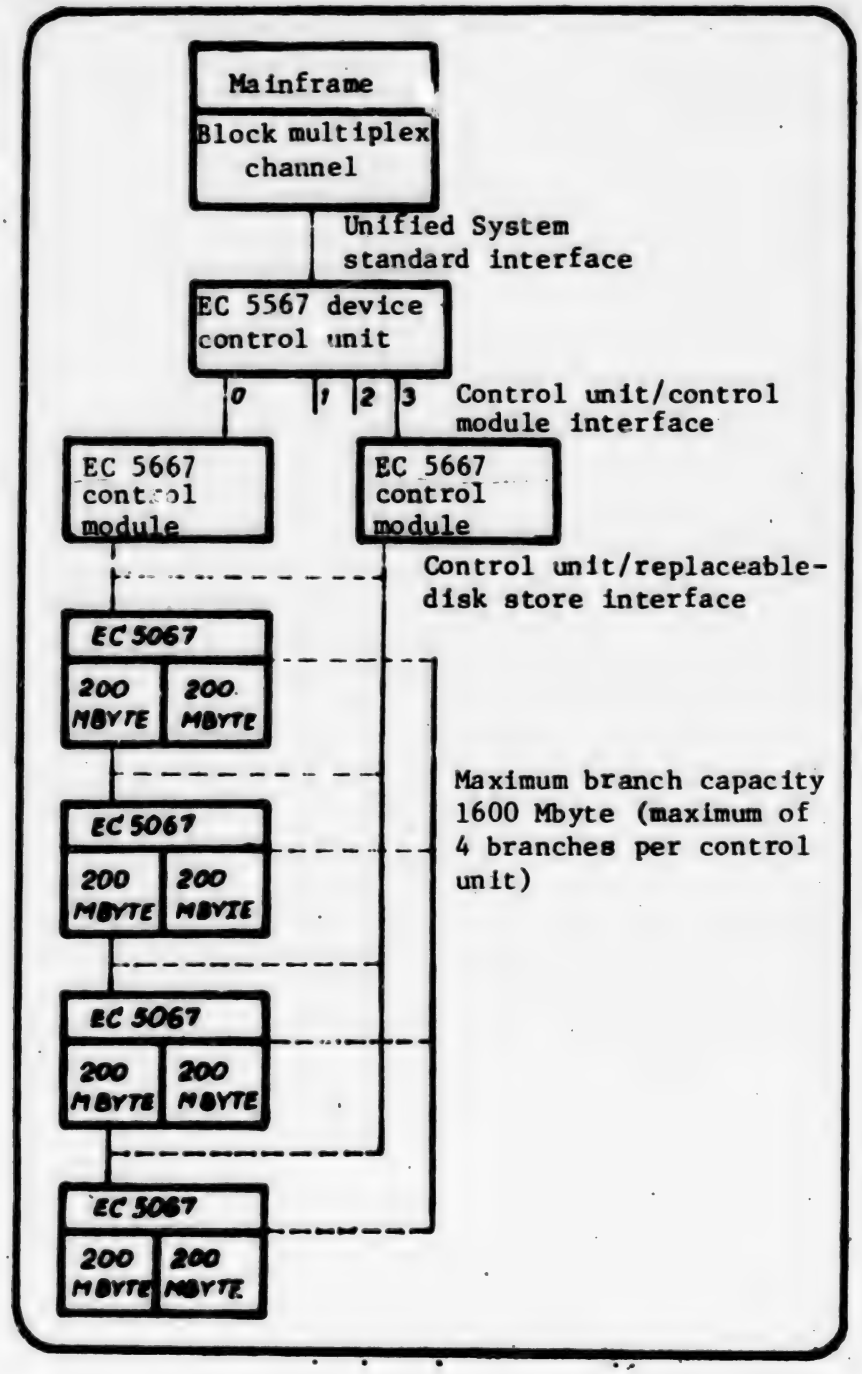


Fig. 13. The replaceable-disk storage subsystem consisting of the EC 5567, EC 5667 and EC 5067.

The individual buses and channels have the following tasks:

--the identification buses (ID BUS) consist of multiplex channels which carry commands (or characters) from the control device to the replaceable-disk store and specify the commands which the memory unit is to execute;

--the control byte buses (BU BUS) consist of multiplex channels which carry signals from the control module to the storage unit and which, together with the signals transmitted by the identification buses, specify the required commands and addresses;

--the triggering (command) channel of the ID bus is a multiplex channel which permits the characters to be decoded;

--the disk store select channel is a multiplex channel which selects a specific disk store from those connected to the control module;

--the sequence channel is a bus which carries the signal that turns on the spindle motors of the individual storage units in the proper order;

--the control bus carries the signal for the heads to be inserted into the disk packs;

--the byte and response buses (BO BUS) are multiplex channels which carry information to the control module on the state of the storage unit or on the chosen address of the storage unit;

--the physical address buses are multiplex channels which carry to the control module the code (3 of 6) of the disk storage unit which is logically connected to it (one of the storage units that are physically connected to it);

--the replaceable-disk unit error channel is a multiplex channel which carries a signal when the storage unit is in an "error" state;

--the read-write data channel is a direct selector channel for bidirectional data transmission;

--the servodata channel is a selector channel which carries several servopulses to the control module during read operations in the disk store.

The interface control block decodes signals transmitted from the control module such as commands and addresses and generates response signals giving the status of the storage unit.

The error block monitors errors in the storage unit which might result in the erasing of valuable information in the disk pack, blocks the reception of input signals, blocks the record circuits, and emits the proper signal to the control module.

To decrease the channel wait time, the address can be transferred to the sector address register. This address is compared by the sector address register comparison module with the current sector address formed in the sector/index block. In addition, with each revolution the sector/index block generates, on the basis of information received from the servosurface a sector/index pulse giving the physical beginning of all tracks.

The address of the required cylinder is sent to the cylinder address register.

The address of the head required is fed to the head address register, which specifies the track within the cylinder in question.

The difference/count register receives the difference between the cylinder address at which the heads are located and the address of the required cylinder. During positioning of the head, the contents of this register are decreased as it passes through each cylinder.

The input control block contains the requisite commands and transforms them to signals to control the servosystem, which in turn controls the movement of the access arm and its precise positioning in the required cylinder.

The linear motor is the servosystem drive mechanism. It also has built into it a rotation sensor which emits signals proportional to the speed of movement of the access arm.

The diagnostic block tests the state of the storage unit and is used primarily for error diagnosis.

The mode-monitor block monitors the performance of the main disk store operations, using the information from a series of nodal points in the plug-in modules and blocks.

The control console is used to start and stop the storage unit and to control its activities.

The logic address box is used to insert the required address into any of the disk stores connected to the control module.

The mechanical blocking unit stores in the disk pack information on interventions by unauthorized persons.

The readout unit picks up the signals read by the head in question and forms them into output data (read data).

The record block receives from the control module the data to be recorded and carries out the recording operation using the selected head.

The head select block is used to physically connect the selected (single) head to the record or readout block.

The servodata block acquires data emitted by the servohead and transmits the information to the proper blocks for emission of sector and index signals, control of the servosystem and synchronization of the data during the write operation.

The head positioning block generates a pulse during passage through each cylinder, as well as a signal to position the heads in a given location with respect to the axis of the track.

Technical Data

Connection to EC 5667 control module	Small interface with four direct cables (selector cable) and a "railway" cable (multiplex cable)
Capacity of one disk pack	100 Mbyte
Number of spindles	2
Number of working sides per disk pack	19
Number of service sides per disk pack	1
Number of magnetic heads	20
Number of tracks per side (number of cylinders)	404 + 7 reserve
Rotary speed of disk pack	3,600 rpm
Recording method	MFM
Data transmission speed	806 kbyte/sec
Positioning time	
minimum	10 msec
average	30 msec
maximum	55 msec
Disk pack spinup time	Less than 20 msec
Disk pack stopping time	Less than 20 msec
Disk pack used	EC 5266
Power consumption	5 kW
Line voltage	3 N average 380/220 V $\pm$15%
Line frequency	50$\pm$1 Hz

Main dimensions	
width	1190 mm
depth	960 mm
height	1145 mm
Weight	55 kg

Table 1. Technical data on Bulgarian replaceable-disk storage units

Parameter/device	EC 5052	EC 5061	EC 5067-01	EC 5067
Number of record and read heads	10	20	20	20
Capacity of unit (Mbyte)	7.25	29	100	200
Cylinder units	200	200	404 + 7	808 + 7
Maximum positioning time (msec)	95	80	55	55
RPM	2400	2400	3600	3600
Transmission speed (Mbyte/sec)	156	312	806	806
Recording density (bits/mm)	29-44	60-90	159	159
Units/control unit	8	8	8	8
Associated control unit	EC 5551 EC 5552 EC 5555 EC 5558	EC 5561	EC 5567 control unit EC 5667	EC 5567 control unit EC 5667

4. Collection of Primary Data on Magnetic Media

The data collection devices developed and produced in Bulgaria use the following data media: standard magnetic tape 12.7 mm wide with a recording density of 32 bits/mm, and floppy disks 8 inches in diameter.

Bulgaria's specialization in external storage using magnetic media is a solid basis for its rapid and successful solution of several problems which have arisen in the design and production of data collection devices. These are both purely technical problems (magnetic heads, noncontact keyboards, recording systems and the like) and problems of the optimal composition of the operator-data collection device-medium-computer system.

Magnetic tape has satisfactory capacity and good properties. In addition, it is produced by the socialist countries. It has no competitor as regards compatibility

with the different external storage units of the digital computers in use in the countries participating in the unified system of data processing equipment.

The floppy disk is compact and reliable and permits random access. Its use as a data medium in small computers and microcomputers will expand considerably in the future.

The development of magnetic media in Bulgaria has been based on international experience with data entry on punched cards and tape.

4.1. The EC 9002 Magnetic Tape Data Collection Unit

The EC 9002 is the first device of this type produced in Bulgaria. The basic advantages of this device compared with card and tape punch units are the use of a buffer memory for data and the use of magnetic tape.

The high operating speed, current data display, quiet operation and simplicity of selection of the required operating mode or function all increase the efficiency of the device and its operator compared with conventional keyboard-type tape or card punch machines.

Fig. 14. The EC 9002 data collection devices produced in a storage unit plant in Plovdiv.

In addition to the basic product, the following modifications have also been developed:

--a unit which can be doubled (EC 9002-01),

--a device which prints (reads out) information from the tape (EC 9002-02).

The EC 9002 has been in large-series production for some years.

4.2. The EC 9003 Magnetic Tape Data Collection Unit

The EC 9003 can be considered a modernization of the EC 9002; the aim of its development was substantial improvement of the functional, design and applications capabilities.

The EC 9003 is equipped to display current data on the display unit. The Elektronika WL 100 and Junost 603 television receivers may also be used for display. The structure of the unit offers extreme flexibility as regards character assortment and recording density.

Fig. 15

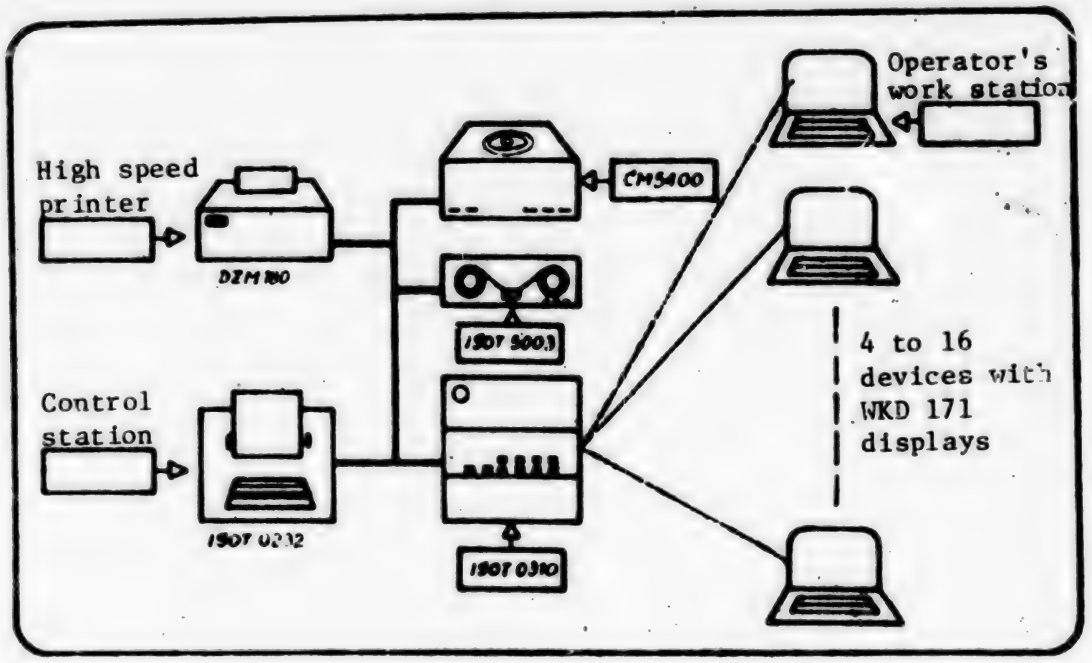


Fig. 15. Configuration of the EC 9003 magnetic tape data collection system.

At the user's request, additional functions such as "sum modulo 10," "sum modulo 11," and "sum of entire field" can be added to the EC 9003.

4.3. The EC 9004 Magnetic Tape Data Collection Unit

LSI circuitry, plug connections with improved parameters and a new tape drive mechanism were used in the EC 9004.

The design of the EC 9004 features a self-contained keyboard and smaller dimensions.

The structure of the EC 9004 makes it possible to add on numerous I/O units, thus considerably expanding the range of applications of the unit. The following modifications have been developed:

--output on EC 7187 printer (EC 9004-2),

--input from card reader (ISOT 6001, EC 9004-3),

--modem for data transmission over telephone lines (EC 9004-04H),

--input from a punched tape reader (EC 9004-5),

--output onto punched tape (EC 9004-06),

--floppy disk storage (EC 9004-07).

4.4. The EC 6901, EC 0112-01 and EC 9113 Floppy Disk Data Collection Units

In recent years Bulgaria has developed (and is systematically engaged in developing) data collection devices which use floppy disks as the data collection medium. Last April, joint tests of the EC 6901 floppy disk data collection unit were successfully concluded. The "zero series" of EC 9112-01 diskette units and EC 9118 converters for converting from diskette to magnetic tape was produced at the end of 1979. All of the products in this complex are designed around the CM 600 microprocessor system. They have modular structure and standard design.

The EC 9113 unit includes:

--a pedestal containing the keyboard and the electronics and power supply module,

--a housing containing two EC 5974 diskettes,

--a housing containing the ISOT 5003 magnetic tape storage unit,

--a monitor.

Thanks to microprocessor control, these devices and random-access external storage units significantly increase operator productivity in comparison with the EC 9002 and EC 9004.

4.5. The EC 9003 Magnetic Tape Data Collection System

The EC 9003 data collection system solves the complex problems associated with data entry and data set input into computers. The use of a general-purpose microprocessor also gives the system a high degree of "intelligence."

The EC 9003 system consists of the following components:

—the ISOT 310 central processor (module 1 and 2) and a memory of 32K [12-]bit words,

—the ISOT 5003 magnetic tape device with a speed of 32 cm/sec, a recording density of 32 bits/mm and the MZR I recording method,

—disk storage with a capacity of 60 Mbyte and a rotary speed of 1500 rpm (CM 5400),

—the ISOT 0232 control console,

—a DZM 180 serial matrix printer with a speed of 180 characters/sec and a line width of 132 characters,

—the EC 0101 16-key keyboard,

—a WKP 171 display with 128 lines and 32 characters per line.

Surveys have indicated that the use of these devices increases operator labor productivity by 40 to 120 percent compared with keypunch units. In addition, the considerable expenditures on data entry, which currently range from 30 to 50 percent of total expenditures on the digital computer equipment, are decreased.

Table 2. Technical data on the EC 9002 and EC 9004 data collection units.

Parameter	EC 9002	EC 9004
Type of buffer memory	Random access	Random access
Basic of modular components	TTL circuitry	TTL circuitry
Type of display	Character by character	Block by block
Type of tape drive mechanism		Single capstan
Recording density	32 bits/mm	8, 22 and 32 bits/mm
Temperature range	5-40°C	5-40°C
Weight	64 kg	48 kg
Dimensions	582 x 641 x 588 mm	582 x 641 x 588 mm

[Table 2. Continued]

Parameter	EC 9002	EC 9004
Reliability	1×10^7 bits	1×10^8 bits
Operating modes	Data input, monitoring and search; program entry and monitoring; input, monitoring and reading from buffer memory	

In spite of the fact that interactive processing shows the greatest promise, data entry for batch processing will predominate in certain applications. It is self-evident that this will require continual improvement of the technical and economic indicators of the individual auxiliary units. In Bulgaria the relevant work is proceeding in two main directions:

--optimization of the main-machine interface for data transcription with expanded functional capabilities, e.g. editing and processing,

--improvement of applications capabilities, particularly device reliability, through new design and manufacturing solutions.

Table 3. Basic parameters of the EC 9112-01 data collection device

Parameter	EC 9112-01
Number of programs	10
Reliability	1×10^7 characters
Mean time between failures	500 hours
Weight	133 kg
Functions	Input, processing, monitoring, search by address, search by content, search by end of data, search by adjacent content, search for beginning, aggregation, test aggregation, copying of small disks, copying of set of data in a particular block, operation with program strings, statistical work by operator

5. Reliable External Storage: Magnetic Tape Units

In recent years, Bulgaria has specialized in external storage. Jointly with the Soviet Union, it has quickly developed magnetic tape storage with modern technical parameters and begun its production. This equipment has large capacity and high efficiency (high transmission capacity, and short access time), and is

reliable and safe to use. Its design meets esthetic and ergonomic requirements. Development of magnetic tape storage units in Bulgaria typically proceeds in two directions:

--large magnetic tape stores with tape speeds of 2 to 5 m/sec,

--smaller units with tape speeds of 0.3 to 2 m/sec.

The large magnetic tape storage units are developed as two groups based on two different designs. The first group is based on the EC 5012 magnetic tape unit and the other on the EC 5003. Small magnetic tape storage units have slower speeds and greater compactness.

The reliability and safety of magnetic tape devices will be improved in the future through a new method of recording which makes possible a higher data density on the magnetic tape (the GRC method for small magnetic tape storage devices), improved drive mechanism design, and the introduction of modern structural components and electronic circuits in the recording and reading channels.

5.1. Large Capacity Magnetic Tape Storage

The EC 5012, the first magnetic tape unit produced in Bulgaria, is being improved continually. As a light-weight device, it is used primarily in systems in Series I of the JSEP. The highest level of this design is the EC 5612 magnetic tape storage device, which has a tape speed of 3 m/sec and uses the PK/NRZ I recording system. In the unified system of data processing equipment, the EC 5612 magnetic tape store is used in subsystems with the EC 5525-03 controller.

Other devices based on the same design are the EC 5012-03 magnetic tape store, which has a tape speed of 3 m/sec and uses the NRZ I recording system, and the EC 5012-01 magnetic tape store with a tape speed of 2 m/sec, using the NRZ I recording system. These two devices operate in subsystems of the unified data processing equipment system with the EC 5517 or EC 5512 controllers.

The advantages of the second basic design, the EC 5003 are:

--automatic tape setup,

--high tape speed, up to 5 m/sec,

--short rewind time, 45 seconds,

--possibility of using cartridges,

--single capstan drive with a vacuum well,

--fixed magnetic head cover.

The device can be included in systems in Series I and II of the JSEP.

The highest level of this design is the EC 5003 magnetic tape storage unit, which has a tape speed of 5 m/sec, uses the PK/NRZ I recording system and has a multiplex diagnostic interface. In the unified system of data processing equipment, the EC 5003 is used in the subsystem with the EC 5503 controller and software of Series I of the Unified System.

The EC 5003-03 magnetic tape store uses the PK/NRZ I recording system and has a tape speed of 3 m/sec and a modified interface for operation in subsystems with the EC 5225 control unit. The interface can be changed by means of various interchangeable modules.

Both groups of large capacity magnetic tape storage devices were developed from single capstan tape drives with start-stop operation: the first variant with vertical and the second with horizontal heads.

Fig. 16. EC 5012 magnetic tape units in use as external storage for a JSEP 1 computer.

The vacuum wells are used to compensate variations in motor parameters, the single capstan drive and the reel motors during start and stop operations. Tape setup is automatic in the EC 5003 and semiautomatic in the EC 5012, using an end piece in the latter case.

The single capstan drive motor and the reel motors of the tape drive unit are controlled by digital servosystems. The motor servosystem in the single capstan drive is informed of the current tape speed by means of a rotation sensor mounted on the motor shaft.

The servosystem for the reel motors receives information on the position of the tape in the wells from sensors located in the wells.

The record head records data on the magnetic tape by means of electronic circuits in the recording channel.

The record channel in magnetic tape units with the combined PK/NRZ I recording system is an integrated circuit design using a type 7445 decoder.

Magnetic tape stores with the combined PK/NRZ I recording system have compensation of static shift of the byte being read. This feature, which is part of the overall control system of magnetic tape units of the EC 5003 series, allows simple change-over from one interface to another.

The following features are protected by patent:

—the modular structure of the EC 5003 unit,

—the control of the single capstan drive motor of the EC 5003/EC 5003-03 devices,

—the control of the reel motors of the EC 5003/EC 5003-03 units,

--the control of the single capstan tape drive in the EC 5612/EC 5012-03,

--the control of the reel motors in the EC 5012-03,

--the record and read channels for the PK/NRZ I system.

Technical data for individual models of large capacity magnetic tape units are given in Table 4.

Table 4. Technical data on Bulgarian magnetic tape units

Parameter	Large capacity devices						Small devices		
	EC 5012-01	EC 5012-03	EC 5612	EC 5003-03	EC 5003	ISOT 5003	CM 5300	CM 5302	ISOT 5006
Tape speed (m/sec)	2	3	3	5	3	0.32	0.32	0.63	1.12
Rewind speed (m/sec)	5	7	7	18	15	2.50	2.50	3.80	3.80
Recording format (number of tracks)	9	9	9	9	9	9	9	9	9
Recording method	NRZ I	NRZ I	PK/NRZ I	PK/NRZ I	PK/NRZ I	NRZ I	NRZ I	NRZ I	NRZ I
Recording density (bits/mm)	32/8	32	63/32	63/32	63/32	32	32	32	32
Width of transmission band ((kbyte/sec)	64/16	96	189/96	315/160	189/96	10	10	20	32
Width of magnetic tape, mm	ISO 12.7^{+00}_{-01}	ISO 12.7^{+00}_{-01}	ISO 12.7^{+00}_{-01}	ISO 12.7^{+00}_{-01}	ISO 12.7^{+00}_{-01}	ISO 12.7^{+00}_{-01}	ISO 12.7^{+00}_{-01}	ISO 12.7^{+00}_{-01}	ISO 12.7^{+00}_{-01}
Reel diameter	267 ISO	267 ISO	267 ISO	267 ISO	267 ISO	267 I3O	267 ISO	267 ISO	267 ISO
Interface	Voltage	Voltage	Voltage	Multiplex	Voltage	Voltage	Voltage	Voltage	Voltage

5.2. Small Magnetic Tape Storage Units

Bulgaria has developed two groups of magnetic tape units with different basic designs, i.e. with reel diameters of 216 and 267 mm. These groups differ in dimensions, hookup distances and tape transport design. The tape transport consists of a single capstan drive with start-stop operation. The compensators for variations in the parameters of the capstan drive motor and the reel motors in start and stop operation have a design with a mechanical lever: a one-level type for slow magnetic tape equipment and a two-level type for fast devices.

The magnetic tape is set up semiautomatically, using a device for the leader or endpiece of the tape. The tape transport motors can be controlled by analog servosystems which receive information on the current tape speed from a DC RPM generator located on the motor shaft of the capstan drive. The lever positions are determined by a photocell with a diaphragm. These two groups of small magnetic tape devices can be included in the configurations of SMEP computers by means of control modules. In addition, they can be used in other data acquisition and storage systems by means of auxiliary equipment.

The small magnetic tape units also have the NRZ I recording system. The magnetic tape parameters make it possible to compensate static shift only during recording.

Table 4 also contains technical data on these models.

6. A Matrix Processor Increases the Productivity of the EC 1035

The number of potential users of auxiliary data processing devices for rapid and efficient numerical processing of extensive data sets expressed as matrices and vectors is increasing steadily. Such computations are required, for example, in the following areas:

--seismic research (geophysics, location of raw materials in the earth's crust),

--image processing (radiology, processing of photographic images),

--space research (telemetry, orbital control),

--nuclear physics research,

--matrix arithmetic,

--solution of differential equations,

--digital signal processing.

Despite their increasing operating speed, modern general-purpose computers cannot meet the requirements for productivity and computational capacity. Multiply-iterated arithmetic operations with the components of large data sets are practically impossible for them. Accordingly, it is necessary to develop special computation equipment such as the EC 2335 matrix processor.

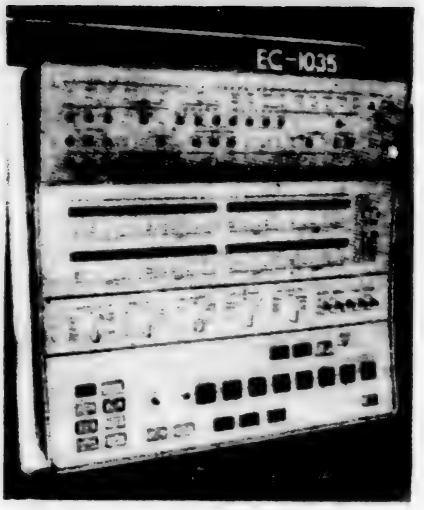


Fig. 17. The EC 2635 mainframe.

6.1. Connections

The EC 2335 matrix processor is connected to the EC 2635 mainframe by a special adapter which is built into the matrix processor and replaces one of the selector channels. The connection between the adapter and the matrix processor is made by a specific input/output interface.

6.2. System Control

From the point of view of the system, the matrix processor and adapter can be considered as an I/O device which combines in itself the functions of channel, control unit and peripheral device. This complex can be controlled by the same system of control words used in the Unified System's I/O systems and by the input/output interrupt mechanism.

6.3. Data Format

Data which are processed in the matrix processor can be expressed in one of three formats which are used in the JSEP:

--fixed point, direct code, short format,

--fixed point, auxiliary code, short format,

--floating point, short format.

6.4. Instruction System

The operation of the matrix processor can be divided into seven groups:

--vector transfer, in which the data are transferred from one field in working storage to another with change of format (from fixed point to floating point and vice versa),

--arithmetic operations on matrices:

  --scalar product,

  --vector product by components,

  --vector sum by components,

  --sum of vector components,

  --partial multiplication of matrix,

  --addition of squares of components,

  --square of matrix with sign,

--inspection of matrices (to determine minimum or maximum components and their positions,

--complex multiplication,

--solution of inequalities,

--signal processing operations (e.g. fast Fourier transformation),

--square interpolation.

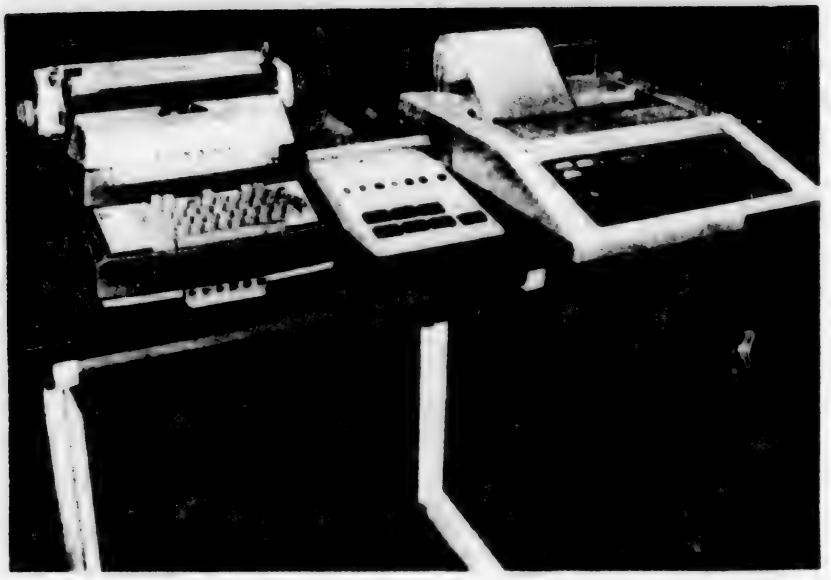


Fig. 18. Input/output equipment of the EC 1035 computer.

6.5. Scope of the System

The matrix processor includes the following groups (blocks):

--a subprocessor to hold and call the operand, which allows connection to the adapter and the EC 2635 mainframe, computation of the operand and control word addresses, and calling of operands,

--the arithmetic subprocessor, which carries out arithmetic operations on floating point numbers according to the pipeline principle,

--buffer memory, which stores operands, intermediate results and final results and serves as a buffer between the interface and the arithmetic subprocessor,

--control memory, which stores control microprograms for the operation of the two subprocessors,

--the microprogrammed control unit.

6.6. Basic Parameters

Duration of one machine cycle: 2 microseconds.

Operating speed: 5 million operations per second (multiplication and addition).

Capacity of interface between adapter and matrix processor: 3.5 Mbyte/sec.

Maximum size of operand: 64K components.

Basis of modular components: TT, 1, 2, 3.

Design: housing with two frames.

Power consumption: 1 kVA.

6.7. Software

The basic software of the EC 2335 matrix processor consists of input programs and a resident module. The module is written in Assembler language using the macro language and conditional assembly features.

Access is initiated by call routines in FORTRAN, Assembler or PL/1, using the SA instruction, which has a fixed format. The resident module performs the interrupt processing by means of a single code specific to the matrix processor.

The access method consists of six phases:

--the control phase,

--the syntactical analyzer,

--the channel program organizer,

--the queue controller,

--issuance of report,

--interrupt processing.

In addition to basic software, the matrix processor software also includes a program system for signal processing. This is a set of routines used to analyze various types of digital signals. The set includes routines which synthesize filters in accordance with specified characteristics and routines which help evaluate the filter effectiveness.

Since there is still insufficient experience and no generally-recognized method for evaluating the productivity of systems of matrix computers, it is difficult to give a general evaluation of the effectiveness of using a matrix processor. However, we have conducted a very large number of experiments in which we processed the same selected examples on an EC 1035 with and without a matrix processor (EC 2335).

The tests confirmed previous calculations to the effect that productivity was increased by 1 to 2 orders of magnitude. For an average measurement of a seismic path, for example, we used 2,000 quanta. The matrix processor was used for certain basic calculations such as deconvolution before and after summarization, filtering before and after summarization, and the use of a planar filter on 10 percent of the data.

The computer took 65.6 seconds to find the path difference using the central processor. This means that processing 300,000 24-channel recordings a year by matrix processor would take about 4,000 hours of machine time, while the system without the matrix processor would require 134,000 hours. Accordingly, for this example the productivity is increased about 34-fold.

7. The ESTEL-4 Data Processing System

The development of data processing in computer networks is a complex, long-term process. Accordingly, when developing the ESTEL 4 system, Bulgaria set itself the limited task of creating a modern teleprocessing system. The system could grow into a computer network or a distributed processing network without any essential changes in its components simply by using new software.

Another important consideration is the compatibility of the ESTEL 4 system with the ESTEL systems currently being produced. This makes it possible to use many applications programs written for the ESTEL 2 and the ESTEL 2.1 in the ESTEL 4 as well. The ESTEL 4 can be connected by means of a byte multiplex channel or a block multiplex or selector channel. In this case the EC 8371 processor operates with two computers simultaneously by means of two channel adapters. If two manually switched channel adapters are used with a single EC 8371 unit, it can be connected to four computers. However, it can operate with only two of them at one time. This capability of the EC 8371 is extremely important for organizing complexes of several machines.

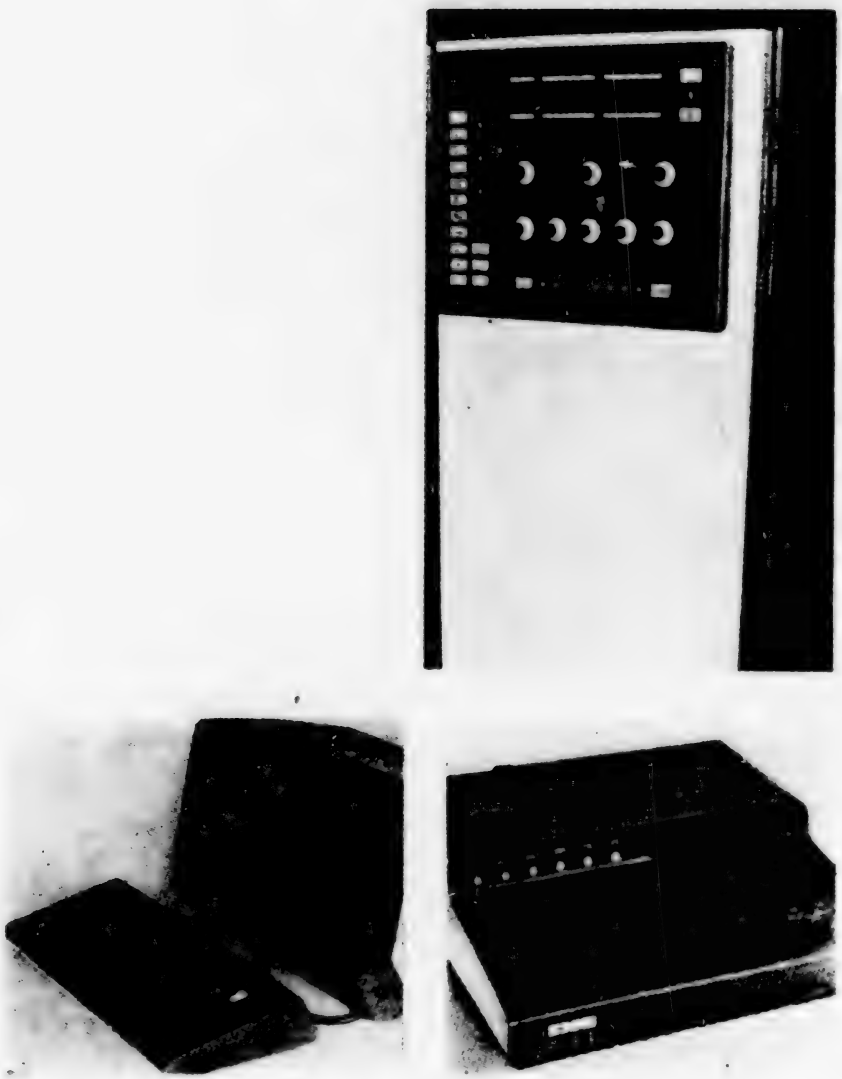


Fig. 19. Devices in the ESTEL 4 system: the EC 8371 processor, the ISOT 7925 terminal with display (lower left), and the ISOT 8500 small terminal (lower right).

7.1. The Processor

The EC 8371 makes it possible to receive up to 352 half-duplex connections at a nominal transmission speed of 12,000 bps. When the transmission speed of certain cables is increased, the number of cables is correspondingly decreased. The transmission speeds are in a wide range from 50 to 56,000 bps. Rates of 50, 75 and 100 bps are used for telegraph lines and rates of 100, 200, 300, 600, 1200, 2400, 4800, 9600, 48,000 and 56,000 bps are used for two-wire and four-wire

telephone lines. The EC 8371 controls the dialing of telephone and telegraph lines from the computer.

The EC 8371 data processing processor operates with a 1-microsecond cycle, giving it a high capacity. The memory is monolithic and can be expanded modularly to 512 kbyte. The network control program operates in the processor; it controls the entire preparatory stage of long-distance transmission, i.e. line control, compiling and distributing reports, formatting and editing.

The network control program is associated with the actual teleprocessing and access method. It is stored in the processor.

The EC 8371 has two types of diagnostic tests. The first type operates under the control of the OS/ES 6.1 or DOS-3ES operating system and monitors the entire EC 8371 unit. The other type of test program consists of internal functional tests which monitor all blocks of the teleprocessing processor.

The teleprocessing processor may also be used as a remote concentrator. In this case, a special device, a remote program storage unit, is installed in place of a channel adapter. This device is equipped with a floppy disk unit which stores the control program transmitted from the computer. The terminals are connected to the teleprocessing processor functioning as a concentrator in the same way as to a local teleprocessing processor.

7.2. The EC 8531 Terminal

The ESTEL 4 system includes the EC 8531 intelligent terminal with working storage of up to 24 kbyte and up to three floppy disk storage units. The basis of the terminal is the EC 7187 printer and an alphanumeric keyboard. To the terminal are connected several types of input and output devices: a 480-character display (12 lines of 40 characters), the EC 7186 (DZM 180) serial printer with a speed of up to 180 characters per second, and the EC 6112 punched card reader for standard 80-column cards.

The programs to be executed by the EC 8531 terminal are transferred to the computer and catalogued, then forwarded as finished programs for execution in the terminal.

When the proper key is pressed, the corresponding program is called from the minidisk which controls terminal operation, provides operator support and the like.

From the device side, the terminal has a transmission rates of 200/300, 600/1200, 2400 and 4800 bps.

A multipoint connection is possible at the I2 or I1 level of the interface unit. It contains an amplifier for a range up to 500 meters. There is no need for a modem or a telegraph interface.

7.3. The ISOT 8531-01 Terminal

The ISOT 8531-01 terminal is a subset of the EC 8531 programmable terminal. It consists of an EC 7187 printer and an alphanumeric keyboard. Input/output buffers and a built-in test system using microprocessor components are provided. The terminal can operate either in the stop-start mode, to which the Bulgarian terminal is adapted, or in synchronous bitwise operation. It can be connected into multipoint configurations at levels I1 and I2. The ISOT 8531-01 has built-in modems for 200/300, 600/1200 and 2400 bps or a switching unit for four-wire telegraphic lines and a current amplifier for distances up to 500 meters and the like. The test feature is supported by test programs which operate under control of the OS/ES 6.1 and the DOS-3/ES operating components.

7.4. The ISOT 7926/28 Terminal

The ISOT 7926/28 terminal and display system consists of a terminal control unit, the ISOT 1926 unit, and a 7928 display. The ISOT 7926 is a display with a 40 cm diagonal monitor (green luminescence) with space for 1920 characters (24 lines of 80 characters) or 2560 characters (32 lines of 80 characters). There are two brightness levels which are software-controlled, as well as a software-controlled protective field. Editing and formatting can be done on the display. Microprograms resident in the microprocessor system make this operation possible. To control the terminal and display, there is control equipment for a connector cable to the computer using the BSC mode and a group for controlling the built-in modem with speeds of 600/1200, 2400 or 4800 bps, or the EC 8027 with speeds up to 9600 bps. In addition, the terminal unit can control up to seven additional ISOT 7928 displays with the same parameters as the ISOT 7926. If desired, this unit can also control the EC 7187 printer, which operates at a speed of 180 characters per second. The distance between the terminal control unit and the display and a separate display must not exceed 1,500 meters. The display terminal system is also monitored by diagnostics controlled by the OS/ES 6.1 and DOS-3/ES operating systems.

7.5. Terminal With EC 9003

The terminal based on the EC 9003 data storage system operates in the remote job entry mode. It consists of a small computer with the requisite peripherals which operates as a control unit for 16 monitor consoles used for data collection.

7.6. Addition of Other Terminals

All terminals of the older ESTEL 2.1 system can be connected to the ESTEL 4: the EC 8501 terminal, the ISOT 7925 terminal and display, the 56 100 terminal and display and the ISOT 8500 small terminal.

7.7. Modems

An interesting feature of the ESTEL 4 is the fact that it uses built-in modems, although external ones can be used as well.

The modems are built into the terminal next to the EC 8371 data processing processor. This is made possible by the decreased size of the modems and the telegraph interfaces (use of MSI and LSI circuitry throughout). For example, the 300 bps modem in the ESTEL 4 takes up only a single interchangeable module. Another characteristic is the extensive use of different loops, local and remote. In connection with the test programs, these loops considerably expand diagnostics of the communications lines, a feature which is extremely important in teleprocessing systems.

7.8. Software

The ESTEL 4 software is also suited for data processing in a computer network. Two operating modes are possible: emulated operation (with the DOS/ES 2.2 and the OS/ES 6.1 operating systems), and basic operation (with the OS/ES 6.1 and DOS-3/ES virtual operating systems).

The virtual method of teleprocessing and access to data in the computer operates with a network control program in the processor and enables all of the above-mentioned terminals to have access to the computer. Here a modified protocol is used for all terminals. It is synchronous, bit-oriented protocol which simplifies and improves the effectiveness of the software and makes possible multipoint connection of various types of terminals on a single line. Thanks to the combination of the virtual teleprocessing and access method with the network control program, the load on the computer is decreased considerably, since this combination takes over management of the line and terminal.

An innovation in the ESTEL 4 is the fact that the information flow control system, which previously was considered to be a set of application programs, is now part of the teleprocessing and access method of the OS/ES 6.1 and expands teleprocessing capabilities. In this connection, the experience with the use of an information flow control system in the OS/ES 6.1 and the DOS/ES 2.2 in the ESTEL 2.1 is extremely valuable. Numerous programming packages for planning, financial calculation, text processing and the like can be connected to the combination of the OS/ES 6.1 with the teleprocessing and access method and the information flow control system.

8. Electronic Desktop and Pocket Calculators

The production of desktop and pocket electronic calculators was begun in Bulgaria in 1966 with the production of the ELKA 21, ELKA 22 and ELKA 25 calculators. These were based on discrete components. Then came the series 40 and 50 desktop calculators using LSI MOS circuitry and the series 100 pocket calculator. Bulgaria is one of the largest producers of electronic desktop and pocket calculators among the socialist countries.

Great progress in manufacturing technology and production of MOS integrated circuits and the development of multiposition display components provide the groundwork today for the production of all nonprogrammable electronic desktop and pocket calculators using a single circuit and display unit.

The calculation capabilities of the various groups of calculators will remain about the same in the future. Further development of these calculators will involve primarily more modern displays and printers. Currently, liquid crystals or displays based on them are proving particularly suitable, since they are simple and cheap and consume little power.

The development of new calculator models is oriented primarily toward new production technologies and inexpensive designs which meet modern requirements as regards color and shape.

8.1. Desktop Calculators With Displays

This group of desktop calculators includes the previously-produced ELKA 22, ELKA 42, ELKA 50 and ELKA 58 calculators. The ELKA 60 and ELKA 61 calculators are in the stage of development and introduction into production. They are based on MOS integrated circuits and multiposition luminescent displays.

The ELKA 60 calculator has a six-position display and one available memory location, carries out the four basic arithmetic operations, and computes percentages and square roots.

8.2. A Desktop Calculator With Printer

Currently the ELKA 55 calculator with a start-stop printer is being produced in Bulgaria in two modifications: one with power-on, overflow and memory-in-use indicators, and one with additional digital indication of the numbers entered and results.

The printer speed is 2.5 lines/second. It has 12 digit positions, a decimal point and two positions for the sign and the arithmetic operation symbol. The calculator performs the four basic arithmetic operations and calculates percentages. It has one usable memory location. The contents of the input register can be exchanged with those of the computation register; the calculator stores the results of multiplication and division in three memory locations available to it. It is designed using MOS integrated circuitry.

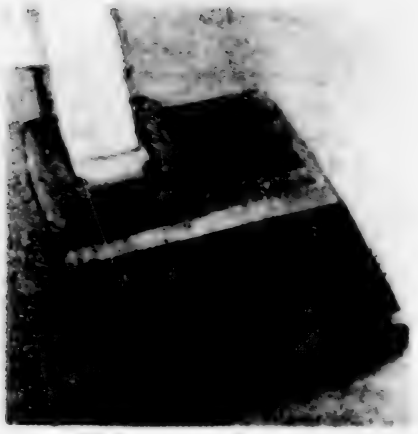


Fig. 20. The ELKA 55 desktop calculator with printer.

The ELKA 65 and ELKA 67, which have the same applications as the ELKA 55, are in the stage of development and introduction into production.

The difference is in their digital displays and shapes, which are modernized. The ELKA 55 calculator has a small digital display using LED's, and the ELKA 67 has a multiposition luminescent display with digits about 8 mm high.

8.3. Programmable Desktop Calculators

These are used to carry out various complex tasks in scientific research institutes, planning organizations, advanced schools and the like. The ELKA 56 is a calculator of this class. It operates in floating point with an eight-digit mantissa and a two-digit exponent. It has ten accessible memory locations and computes not only trigonometric and hyperbolic functions and their inverses, but also logarithmic and exponential functions.

It can be used for various conversions: from rectangular to polar coordinates and vice versa, from degrees to radians and vice versa, metric conversions and the like.

The calculator has the following program capabilities:

--72 locations in the program memory,

--programming and execution modes of operation,

--conditional and unconditional program jumps,

--program revision,

--automatic and stepwise program execution.

The ELKA 56 calculator uses LSI MOS circuitry and luminescent displays.

8.4. Pocket Calculators for Basic Calculations

The output of these calculators has increased considerably in recent years. The devices are used by elementary and middle school students, housewives, women employed in service organizations and the like. We produce several modifications of calculators in this group: the ELKA 101, ELKA 103, ELKA 107, ELKA 130 and ELKA 131. They are 8-digit types which perform the four basic arithmetic operations, calculate square roots and percentages and have one accessible memory location.

8.5. Pocket Calculators for Scientific Calculations

Advanced students, engineers and technicians in scientific research and design institutes use these calculators. The calculators of this type are the ELKA 135 and ELKA 137, which are based on MOS integrated circuitry and right-position LED or luminescent displays. They perform the four basic arithmetic operations, find roots, and calculate the trigonometric functions sin, cos and tan and their inverses, the exponential functions e^x and 10^x and the logarithmic functions ln x and log x. They have one available memory location. They operate in fixed and floating point, in the latter case with a five-digit mantissa and a two-digit exponent.

8.6. Programmable Pocket Calculators for Scientific Calculations

These calculators are less frequently used than the other types of pocket calculators. The ELKA 245, using LSI MOS circuitry and a luminescent display, is being put into production. It has 10 accessible registers and operates in floating point with an eight-digit mantissa and a two-digit exponent. It can be used to calculate trigonometric, hyperbolic, logarithmic and exponential functions. It performs various conversions: rectangular to polar coordinates, degrees to radians, metric conversions and the like. It has the following program capabilities:

--program memory for 72 steps,

--conditional and unconditional program jumps,

--program execution in two modes, automatic and stepwise.

The following authors participated in the preparation of this review of data processing products in Bulgaria:
Dr. K. Boyanov, Kh. Karadzhov, S. Khristova, S. Aleksandrova, M. D. Bolen, B. M. Zonev, T. A. Topalov, S. B. Paskalev, B. K. Khristova, T. Popov, M. Kolarov, G. Momerin, G. P. Nikolay, V. D. Lazarov, G. P. Daskalov, Y. V. Ivanova, K. D. Kirov, S. I. Zheleznov and Y. Yulsari.

8480
CSO: 2402/68

COOPERATION IN COMPUTER APPLICATIONS TO RESEARCH HAILED

Budapest NEPSZABADSAG in Hungarian 24 Jul 81 p 6

[Article by Gabor Pal Peto: "One Topic, Three Cities, Six Research Facilities"]

[Text] The competition, within the framework of which university researchers receive extra grants for the purchase of materials, instruments, etc for research on topics they themselves suggest, was announced this year for the second time. Because of this, perhaps now is the best time to recount the results achieved in the first competition announced at the suggestion of, and financed by, the government's Committee for Scientific Policy.

Practically unique in its kind and in the information derived from it, was the research project related to the application of the so-called pattern [shape] recognition: this work was performed by a total of about 30 researchers in six research facilities in three cities.

Before we introduce the quite complicated concept of pattern recognition, it is worth while reviewing how this research project, multi-faceted in every sense, yet at the same time coordinated, came about.

What Patterns Must Be Recognized?

A seven-member research group headed by Dr Gabor Veress, has been operating for years at the Budapest Technical University [BME], in the General and Analytical Chemistry Department--in academician Erno Pungor's institute. Its assignment is the application of computer technology methods in chemical analysis. The mathematical and systems theory method called pattern recognition is also related to this task. From the nature of research follows, especially in a small country like Hungary, that people working in related fields know about each other, and often may even know each other. Thus when the opportunity presented itself--on the occasion the 1978 competition was announced--to receive extra grants for deeper research into their topics, they pooled their efforts and submitted a joint proposal: the above mentioned group, a few people from BME's Agricultural Chemical Technology Department, a couple of co-workers of MTA's [Hungarian Academy of Sciences] Technological Chemical Research Institute (Veszprem), the computer technology groups of Szeged University of Medical Sciences and of Semmelweis University of Medical Sciences in Budapest, and a few researchers of MEM's [Ministry of Agriculture and Food Industry] Food Control and Chemical Investigation Institute.

Six research facilities in three cities, one associated with the academy and one with a ministry, in addition to four university groups--one can imagine that coordinating the work was not the easiest. This became Dr Gabor Veress's job who says now that it was a very tiring but also very educational task. The way they started out is also very educational for others: when they received the assignment, all participants attended a 3-day conference in Veszprem where they thoroughly familiarized themselves with the theoretical foundations of their topic with the aid of outside experts, and evaluated the results achieved up to that time. This accelerated the development of these co-workers, and they also saw more clearly what had been done until then and how they should divide up the work.

But, what is shape recognition? The Hungarian name itself is difficult to understand because it is an inaccurate translation of the English original, which talks about pattern, referring to formation. It is true, however, that this does not take us much closer to understanding the thing, either. What is involved here is that various things--which may be objects, but may also be concepts--are to be listed into classes on the basis of data, for the most part measurable data, but these are not very simple so that classification is not possible on the basis of measuring one single characteristic.

I heard a very good comparison from Dr Veress. Let us imagine that we have to separate horses and donkeys on the basis of measured data. This appears to be a simple task because the donkey is gray, small, and his ears flop. However, there are also gray horses, larger donkeys, and also smaller horses with floppy ears! Thus we can get into quite a big confusion even with this simple task.

But, to get serious now: pattern [shape] recognition is usually related to processing measurement data, and the classifications must be created on the basis of this. One such series of data can be, for example, the curve of EKG examinations, on the basis of which the persons studied must be classified as ill or healthy. The qualification of foods is a similar task: for bread, for example, the basis of this is its hardness, water content, etc. In the case of drinks the qualification is done on the basis of evaluating the chromatograph curve: its peaks indicate the quality and quantity of the individual components. And actually the problem of pattern [shape] recognition is related to this in chemical analysis also: the future of high performance chemical analysis is in automation, which does not work without rapid processing of the data ("classification" of the materials studied!), and this leads one to computerized processing.

It becomes obvious from all this--even though we have extremely oversimplified the matter--that basically we are dealing with computerized evaluation of measured data, which also requires extremely complicated mathematical work. The researchers of six research facilities in three cities banded together to accomplish this, and also at the same time to immediately work out practical applications.

Help for the Doctor

It would not even be possible to list the results of more than 2 years of joint effort. Since--no matter how surprisingly this may sound--the mathematical foundations of medical diagnosis, chemical analysis and food qualification methods are the same as far as the application of pattern recognition is concerned, they were

able to eliminate a whole series of parallel and thus unnecessary work, they were able to share the computer programs, the theoretical knowledge and even the practical application experience with each other, regardless of how much the specific form of their work projects differed.

Yet--in outlines--the main results of the separately and jointly performed work can be summarized as follows:

A comprehensive theoretical treatise was born.

So were 17 computer programs, or rather, program systems, besides this.

A whole series of medical applications has become possible with the aid of these. One of these is the reparation of recovery prognosis of heart attack victims. Another one: investigation of the dangers in the position of a fetus, advanced indication of whether irregularities should be expected at birth. (This can be "predicted" on the basis of delivery pains and of the characteristics of the sound of heart beats.) Another possibility: In the case the newborn has jaundice it must be decided whether blood replacement is to be undertaken or not, and this is an operation not without dangers. This decision can be made on the basis of six parameters, and according to experience gained thus far, the number of newborns who need, or who do not need their blood replaced, can be classified with 80-90 percent accuracy, that is, this is the ratio of agreement between decisions made on the basis of the computerized pattern recognition method, and the doctor's decisions. And, to still remain with medical applications: 93 percent correct decisions were made on the basis of the computerized model in diagnosing imflammation of the pancreas, based on 14 characteristics.

Chemical analysis has also derived great benefits from pattern recognition research: the results served as foundations for methods by which the data obtained from mass-spectrometric and infrared spectrometric measurements can be classified faster, automatically and with savings in human labor, that is, the composition of the materials measured is easier to determine.

Bread, Coffee, Cognac

A method which is easily applicable to qualifying food was also developed. Some foods are qualified on the basis of judgement by the senses, or by preference to put it simply, when the jury's members evaluate the goods they taste, by awarding it points. However, one cannot be certain whether these really express the objective quality of the food item in question. Therefore, based on this research, the data obtainable with measuring instruments, and the results of evaluations obtained by examining them with the senses were evaluated for a whole series of foods, and it was concluded that for some foods the point system must be modified to really correctly evaluate these products. This is how the results of pattern recognition research were used to qualify spice paprika, tea, coffee, Parisian sausage [large diameter, meaty Wieners], butter, bread, plain cake, potato bread, crescent-shaped rolls, bread rolls, milk, and some alcoholic beverages. And the results even provided the method for recognizing imitations.

These appear to be divergent and differing tasks--and yet, the common characteristics of their solutions were discovered through joint work. Thus the medical science, chemistry and also food qualification--and by generalization of the results, science as a whole has also gained much from it. Nothing else was needed for it than support for the dormant ambitions of the university research groups. For this reason we are justified in having expectations from the research project competition now being announced again.

8584
CSO: 2502/88

COMPUTER AIDED MACHINING OF PRINTED CIRCUIT BOARDS

Budapest FINOMMECHANIKA MIKROTECHNIKA in Hungarian Vol 20, No 6, Jun 81 pp 176-179

HALLER, H., commercial director, Excellon Europa GmbH, West Germany

[Abstract] In his lecture delivered at the "Printed Circuit Board Seminar 1980," held 21-23 May 1980 in Lahnstein, the author discussed three DNC (the abbreviation now standing for Distributed Numerical Control, while earlier it stood for Direct Numerical Control) system of increasing capability levels for machining printed circuit boards. The DNC-1 system consists of an RS 232 computer, an interface, and an Excellon machine; it provides no feedback. The DNC-2 system uses an OPIC-III programming unit and floppy disk for data storage, and can control up to eight drilling and/or milling machines. The DNC-III system comprises a central processor unit, a hard-disk background memory, and a programmer, capable of operating up to 20 machining units in real time, and offering feedback capability. The main advantages of DNC systems are: economical central storage of the program sections, security of the stored data, absence of data carriers at the manufacturing site, reliable electronic data transmission to the fabricating machines, saving of time, and easier maintenance. An economic study indicated that major savings could be realized by their introduction. Figures 4, table 1, no references.

2542
CSO: 2502/86

MANUAL AND AUTOMATIC CONTROL OF PHOTOMASKS AND SOLID STATE WAFERS. PART I

Budapest FINOMMECHANIKA MIKROTECHNIKA in Hungarian Vol 20, No 6, Jun 81 pp 183-191

HONTY, Laszlo, staff scientist, MTA [Hungarian Academy of Sciences] KFKI [Central Physics Research Institute] MSZKI [expansion unknown]

[Abstract] In this first part of a series of articles the author discusses the following subjects: overview of photomasks (types, applications, design, construction, manufacture, and quality control), overview of the major faults encountered in photomasks (pinholes, intrusions, extrusions, geometric distortions, gaps, dimensional accuracy, and so forth), classification of photomask quality control equipment types, some major features of microscopes used in the control systems (stage movement, object size, absence of vibration, magnification, field of view, illumination, photography, measurement of dimensions, ergonomic aspects), the optical requirements for the microscopes with special emphasis on their ability to show edges, and a classification scheme for microscopes and other optical devices for dimension checking (including comparison-microscopes for the identification of random faults). The procedures used in the quality control of photomasks affect the quality of the check as much as do the engineering parameters of the instruments employed. Figures 9, tables 2, references 3: 1 Hungarian and 2 Western.

2542
CSO: 2502/86

NEW UHF DIPLEXER

Budapest HIRADASTECHNIKA in Hungarian Vol 32, No 5, 1981 pp 194-196

SZABO, Pal, Dr, graduate electrical engineer, department head, and FURST, Lajos, graduate electrical engineer, group leader, BHG [Beloiannisz Communications-Engineering Factory] Development Institute

[Abstract] Based on 10 years of operating experience with the UHF-FM system in Hungary designed to insure satisfactory reception of the Kossuth, Petofi, and 3rd-program transmitters, a new UHF diplexer type was developed, of which the primary advantage is that it is easier and more economical to build. The modifications involve the use of hard soldering of the contacts of the filters and of screw joints at their connections; the use of a new mantle made of silver-plated copper in the 3 dB hybrid component, the use of aluminum-alloy feedlines; the use of a specially designed KONTASET cabinet; and the use of a summating automatic system for better separation of the transmitters. The new system offers engineering parameters that are at least as good as those of the first-generation system, and its reliability is expected to be better. The critical area in the first-generation system was the short-circuiting of the filters; thus development of the second-generation system stressed modifications in this area. For this reason, the adjustments of the L and C parameters were made less prone to malfunctioning, and increased attention was given to the cooling design. Figures 3, no references.

2542
CSO: 2502/87

UDC: 681.583:550.8.08:536.45

DESIGNING OF HIGH TEMPERATURE OPERATIONAL AMPLIFIERS

Budapest MERES ES AUTOMATIKA in Hungarian Vol 29, No 5, 1981 pp 169-176
manuscript received 9 December 1980

VAMOS, Attila, SZKFI [expansion unknown]

[Abstract] The designing of operational amplifiers assembled from discrete components for use at high temperatures (up to approximately 280°C) in applications such as probes for geophysical depth measurements is discussed. Theoretical and practical studies were carried out to establish the upper temperature limit of circuits with bipolar silicon transistors, silicon diodes, and Zener diodes; the temperature-dependence of solid-state parameters; and the adjustment of the working point and stability of transistorized amplifiers. The basic circuits of operational amplifiers (emitter followers, voltage amplifiers, and current generators) were reviewed on the basis of the results of these studies, and circuit designs for operational amplifiers and measuring amplifiers were tried. Finally, the temperature characteristics of amplifier circuits found promising on the basis of the trials were evaluated in laboratory and field experiments. The best circuits had an upper operating-temperature limit of almost 300°C and highly satisfactory resistance to aging. These circuits could be installed in sturdy and durable casings for operational use. Figures 10, no references.

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